PAKISTAN NUCLEAR STUDY

4/26/78

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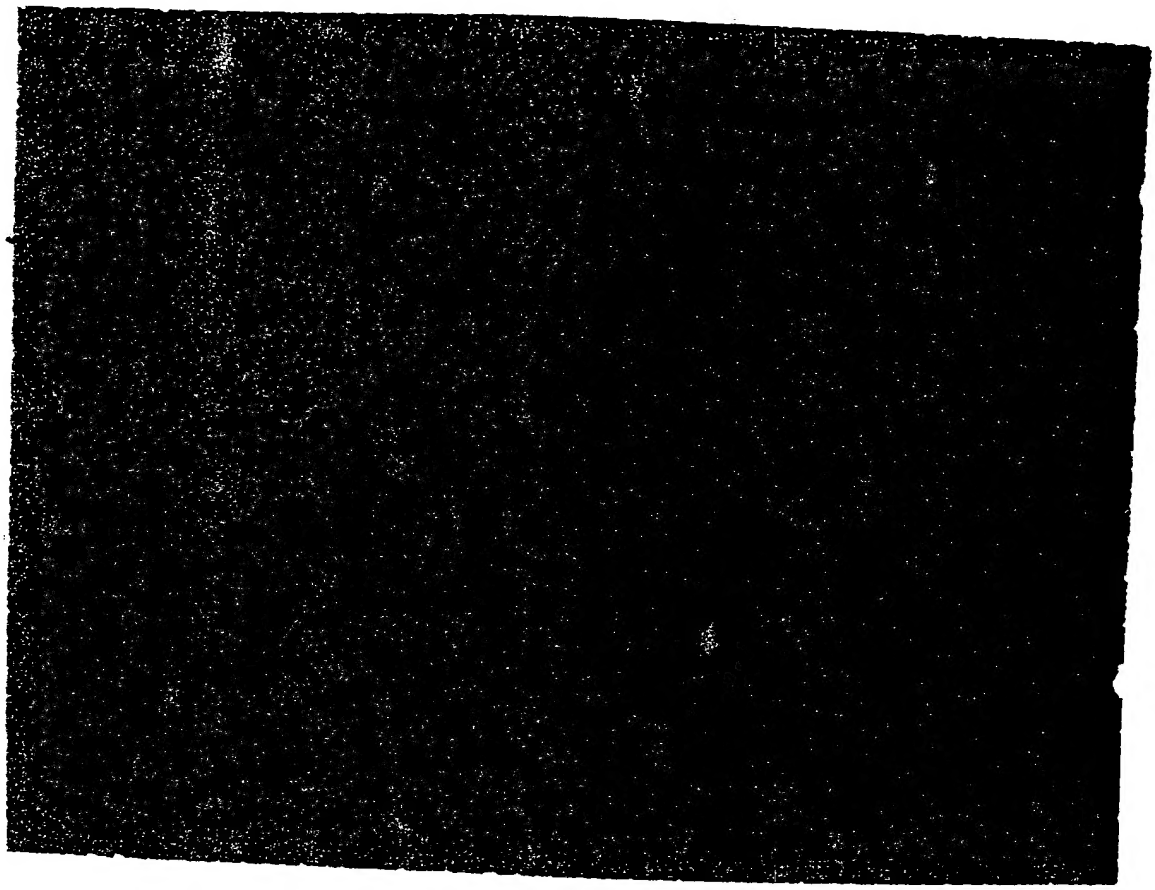

The Technical Base: Pakistan's Nuclear Program

20. Pakistan's nuclear program had its beginning with the establishment of the Pakistan Atomic Energy Commission (PAEC) in 1963. Under the Pakistan Ministry of Science and Technology, the commission was geared to basic nuclear research, the use of radioisotopes, and the eventual development of nuclear power. In late 1972, the PAEC was placed

directly under the then President Bhutto. When Bhutto subsequently became Prime Minister, the commission was transferred to his new office. It is now under General Zia, the Chief Martial Law Administrator (CMLA). The PAEC is made up of four full-time members under the chairmanship of Munir Khan.

21. The principal research center of PAEC activities is the Pakistan Institute of Nuclear Science and Technology (PINSTECH) at Islamabad, constructed in the late 1960s. The central element of this research center is a 5 megawatt (thermal) pool type reactor of American design, similar to ones in Iran, Israel and the US. It is fueled with highly enriched uranium supplied by the US under safeguards. The reactor is used for isotope production, neutron physics experiments and for training reactor technicians. It has the capability to produce a maximum of 100 grams of plutonium per year. PINSTECH also has a number of pilot facilities which reportedly include a laboratory-scale facility for reprocessing irradiated reactor fuel.

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22. The only operating power reactor--and the only source of sizable quantities of plutonium--is at the Karachi Nuclear Power Plant (KANUPP). This plant has a CANDU-type, heavy water moderated, natural uranium fueled reactor built by Canadian General Electric. All of the fuel and the initial 110 tons of heavy water for this reactor were supplied by Canada. It went into full commercial operation in December 1972 and now provides 137 megawatts of electric power, about 25 percent of the power needs of the city of Karachi. There have been problems involving corrosion of heat exchangers reaulting in considerable loss of heavy water, and the replenishment of the heavy water inventory has been a matter of some concern.

23. Operated at normal ratings, the KANUPP reactor should produce about 60 kilograms of reactor-grade plutonium per year. If it were operated in a mode optimized for production of weapons grade plutonium--to the detriment of power production and at the cost of greatly increased fuel requirement--it could produce between 60 and 120 kilograms of reactor-grade plutonium are now in the spent fuel rods that are awaiting disposition in KANUPP's cooling pond. None

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of this plutonium will be available for use in a device until fuel reprocessing facilities are available.*

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24. New fuel for the KANUPP reactor will be required by the summer of 1978. The fuel was to have been supplied by Canada but in late December 1976 Canada terminated its nuclear cooperation program with Pakistan. At about the same time, Pakistan announced that negotiations had begun with Niger for the purchase of uranium which is to be fabricated into fuel possibly by a third country. Niger has told other prospective uranium buyers that initial shipments could not begin before 1980, [redacted] If early delivery is possible, and if fabrication into fuel assemblies can be arranged, Pakistan will have an immediate alternative to Canadian-supplied uranium for fuel.

25. When Canada cutoff its aid, the major nuclear facilities in Pakistan had all been turnkey projects--constructed and commissioned by foreign personnel with little domestic participation. Pakistan had depended on Canada for heavy water, fuel, spare parts and emergency repairs for the KANUPP reactor.

* Reactor-grade plutonium is "dirty" plutonium (i.e., with high Pu-240 content) produced in a power reactor in normal operation. It can be used in weapons, but is not ideally suited to that purpose.

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on the US for enriched uranium for the PINSTECH research reactor, and mainly on the US and Western Europe for the advanced training of nuclear personnel. With continued nuclear aid from western suppliers in jeopardy, Pakistan turned to China for aid. In late December 1976, it asked China for fuel, technology and spare parts to keep the KANUPP reactor operating and for nuclear material (plutonium) in the event the reprocessing plant were not built.

26. It is unlikely that China will agree to furnish plutonium, but we cannot rule out the possibility that it will help Pakistan to keep the KANUPP reactor operating. China has limited experience in the operation of heavy water reactors and would not be in a position to provide sophisticated CANDU-type equipment (e.g., a refueling machine) if the need arose. The Pakistani need for heavy water and fuel rods probably could be met by the Chinese, but the fuel rods would call for some research and development work beforehand. But the exact status of current Chinese-Pakistani nuclear collaboration remains unknown.

27. The Pakistanis have long sought an indiginous supply of uranium. Their efforts have apparently shown some success, though we do not know its exact dimenions as to quality or quantity. In 1977, mining activities in the Dera

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Ghazi Klan District in western Punjab were reported to have produced 150 tons of uranium ore. Though this may be of little international commercial value, it could be sufficient to fuel the KANUPP reactor. In addition the Pakistanis have apparently made progress in fuel fabrication and could have a plant in operation by late 1979.*

28. Pakistan has also undertaken negotiations with various foreign countries for purchase and installation of facilities for nuclear fuel fabrication and heavy water production, as well as for fuel reprocessing. If these plants are constructed--and this is uncertain--and if Pakistan obtains a reliable source of uranium, it would have attained the complete nuclear fuel cycle for natural uranium power reactors such as the one now at Karachi. (See the figure).

29. The ability of developing countries to purchase full fuel cycles without arousing concern among supplier countries, however, has greatly diminished since the Indian nuclear test. Time and effort expended on negotiation will be greatly increased

* [redacted] Pakistan is trying to develop a nuclear fuel fabrication plant near PINSTECH and supposedly another near a uranium mine in the northern part of the country. The one near PINSTECH is still only in the design stage, while ground has been broken for the building for the plant in the north. The latter, however, probably will be capable of producing only the essential ~~material~~ natural uranium fuel for KANUPP. They have given top priority to that task and should be able to accomplish it within two years". [redacted]

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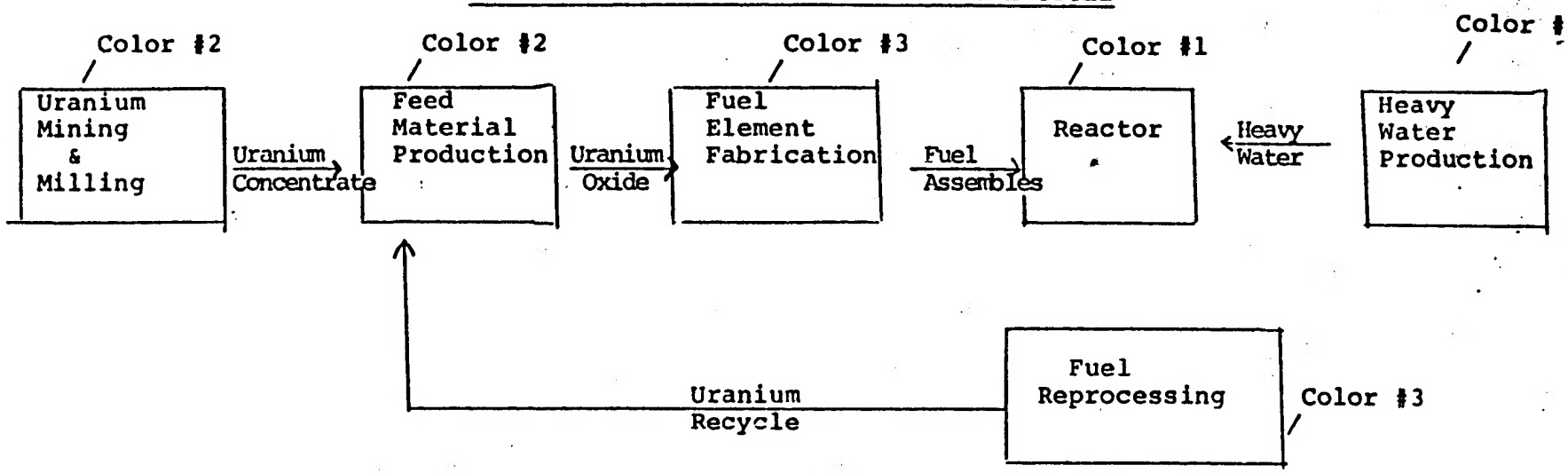
PAKISTAN AND THE CANDU REACTOR FUEL CYCLE



(Color # 1) Facilities Operational

(Color #2) Facilities Planned

(Color #3) Facilities Planned, Purchase Negotiations Begun

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and safeguards will be much stricter than in the past. All major facilities acquired henceforth by Pakistan will almost certainly entail safeguard agreements forbidding use of their products in any nuclear explosive device.

The French Fuel Reprocessing Plant and Alternative Sources of Plutonium

30. Pakistani efforts to acquire a reprocessing facility began shortly after completion of the KANUPP reactor and were intensified following the Indian nuclear explosion. An agreement was finally reached with France in February 1975 to supply a safeguarded plant with a design capacity to reprocess 100 tons of fuel per year using the solvent extraction process. If built, it would be capable of reprocessing natural uranium (CANDU-type fuel and also the slightly enriched uranium fuel used in the types of power reactors planned for future construction. The plant was originally scheduled to go into operation in the early 1980s, and construction based on drawings already transferred has begun on the main processing building at a site near the Chasma dam in the North West Frontier Province. Both countries originally approved the sale of the reprocessing plant and obtained the sanction of the IAEA.

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31. However, the odds appear to be sharply increasing that the plant will not be completed, at least according to original specifications, in the foreseeable future. The government of France has shown an increasing reluctance to build the plant as it was originally designed. Paris has since suggested either a "" coprocessing" or "apparent co-processing" technique which would produce [redacted] mixture of plutonium and uranium which is not suitable for weapons use. But the Pakistanis might, in time, be able to develop an additional (and unsafeguarded) facility which could separate the plutonium and make it available for nuclear explosions.

32. The present Pakistani martial law administration has strongly resisted these French suggestions for change. And it does have some limited leverage over the French. The reprocessing plant is part of a larger package of French sales to Pakistan including, besides the reprocessing plant, civilian and military aircraft, the Chasma nuclear power project, a truck plant and a color TV system. On the one hand, the French originally insisted that Islamabad take the entire package; on the other, the Pakistanis threaten to cutoff purchase of everything if the deal for the reprocessing plant does not go through.

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33. The Pakistani military rulers would almost certainly refuse to give up the prospect of getting French military aircraft, but could well sacrifice such as a color TV system as a luxury the country cannot now afford. Other French items would probably be bought or not bought on their individual merits. And if the French do renege on their reprocessing plant agreement, they are not likely to be in much of a position to object to selective elimination of other items in the package.

34. The economic justification for acquiring a reprocessing plant has always been questionable even were the reactors for the Chasma nuclear power project to be built. The reason given for acquiring the plant is that it will be needed in the late 1980s and that it is cheaper to build it now. The certainty that Pakistan will be unable to meet its ambitious goals for nuclear power reactors in the 1980s adds to the argument against embarking on a reprocessing venture at this time.

35. Although the capacity of the proposed plant is much larger than would be required to process KANUPP fuel from normal power operation, it is of an appropriate size to handle the KANUPP output if the reactor should be operted in a manner to maximize the production of weapons grade plutonium. This does not necessarily lead to the conclusion that the reprocessing plant is intended for weapons use but it is certainly suggestive fo such use.

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36. If built, the reprocessing plant is to be under a trilateral (IAEA-France-Pakistan) safeguard agreement forbidding the use of the product in making nuclear explosives or the transfer of French technology to unsafeguarded facilities. When negotiations began in 1973, France had indicated that little or no safeguarding would be required on the sale but, influenced by the Indian nuclear explosion and the increased concern on the part of all suppliers about the spread of nuclear weapons, Paris re-evaluated its stand and decided more stringent safeguards were necessary. Pakistan originally resisted but France held firm on its decision.

37. Both of Pakistan's currently operating reactors are safeguarded by the IAEA, as is the enriched uranium used for fabrication into booster rods for the Pakistani KANUPP (power) reactor and the enriched uranium used in the PINSTECH (research) reactor. There are, however, loopholes in the language defining the end use of supplied materials for these reactors. Specifically, the agreements only prohibit military uses and do not prohibit all nuclear explosive devices. Conceivably Pakistan could seize on this, as India did, to justify a "peaceful" nuclear explosion using safeguarded material. The agreement the French and Pakistanis have concluded for the reprocessing plant, on the other hand, includes language prohibiting the use of reprocessed material in <u>any</u> nuclear explosive device. It also includes a prohibition on the

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replication of the of the reprocessing facility or any of its equipment or technology for 20 years.

38. There are major difficulties, however, in safeguarding any reprocessing facility. Unlike power or research reactors, the design of each reprocessing plant is unique, which necessitates the determination of safeguards specific to that facility--a time-consuming process that requires extensive personal inspection. In addition, the IAEA has never before been called upon to safeguard a reprocessing plant. Compounding the problem of the plant's design, therefore, is the IAEA's general lack of experience in the area of reprocessing safeguards. Short of round-the-clock physical inspection of a reprocessing plant it is questionable whether safeguarding such a facility is really effective. Because the time between diversion of plutonium and its conversion into nuclear weapons could be sharply reduced if a country were determined to pursue a policy of diversion, nuclear weapons could already be assembled before an effective international reaction could be mustered.

39. If Pakistan opts to pursue a series nuclear weapon program, it will need the French reprocessing plant or some equivalent. The French believe that the Pakistanis have

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the know-how and enough of the plans and drawings to complete and operate the plant on their own. Other experts, including American area, do not think that this is the case, and that dependence on the French will continue for many years.

40. Such a plant is not the only conceivable source of plutonium for a single nuclear device test, however. The Pakistan Institute of Nuclear Science and Technology probably has a laboratory-scale fuel reprocessing facility. Pakistan might thus attempt--though this is unlikely (see below)--to produce sufficient plutonium using manual methods in this or some similar installation. The facility in question was designed to produce only grams per day, but with modifications might serve to produce sufficient plutonium for a single nuclear device in roughly the same time scale considered for the reprocessing plant; i.e., at sometime in the first half of the 1980s. Should this occur, however, Pakistan would still be many years from developing the reprocessing ability enabling it to stockpile weapons.

41. Indeed, the authorities in Islamabad are almost certainly aware that exploding a single device without having a further stockpile of fissionable material would be an extremely dangerous step. However much it would enhance

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Pakistan's prestige in the eyes of Pakistanis, it would also alarm the Indians and--in their eyes--invite some kind of response. By the early 1980s India will have large quantities of unsafeguarded plutonium and a proven ability to set off a nuclear explosion. This is not to say that India would automatically embark on a weapons program, largeor small, but the odds in favor of its doing so would be greatly enhanced by a Pakistani test. And were India to do so, Islamabad could not counter with a program of its own--thereby enhancing India's strategic superiority even further.

43. Thus the acquisition of facilities which would enable Islamabad quickly to respond to an Indian weapons program with one of its own becomes an inescapable corollary of any nuclear explosive plan. As of April 1978, French-Pakistani negotiations as the matter were continuing, and could well do so far some time. Were Pakistan to be unable to get the reprocessing plant from France, the odds favoring any sort of explosive program on its part would sharply diminish.

43. For this reason, Islamabad could conceivably opt to build a small crude reprocessing facility on its own. There have been descriptions in the open literature of such "quick and dirty" installations. Most if not all the needed materials

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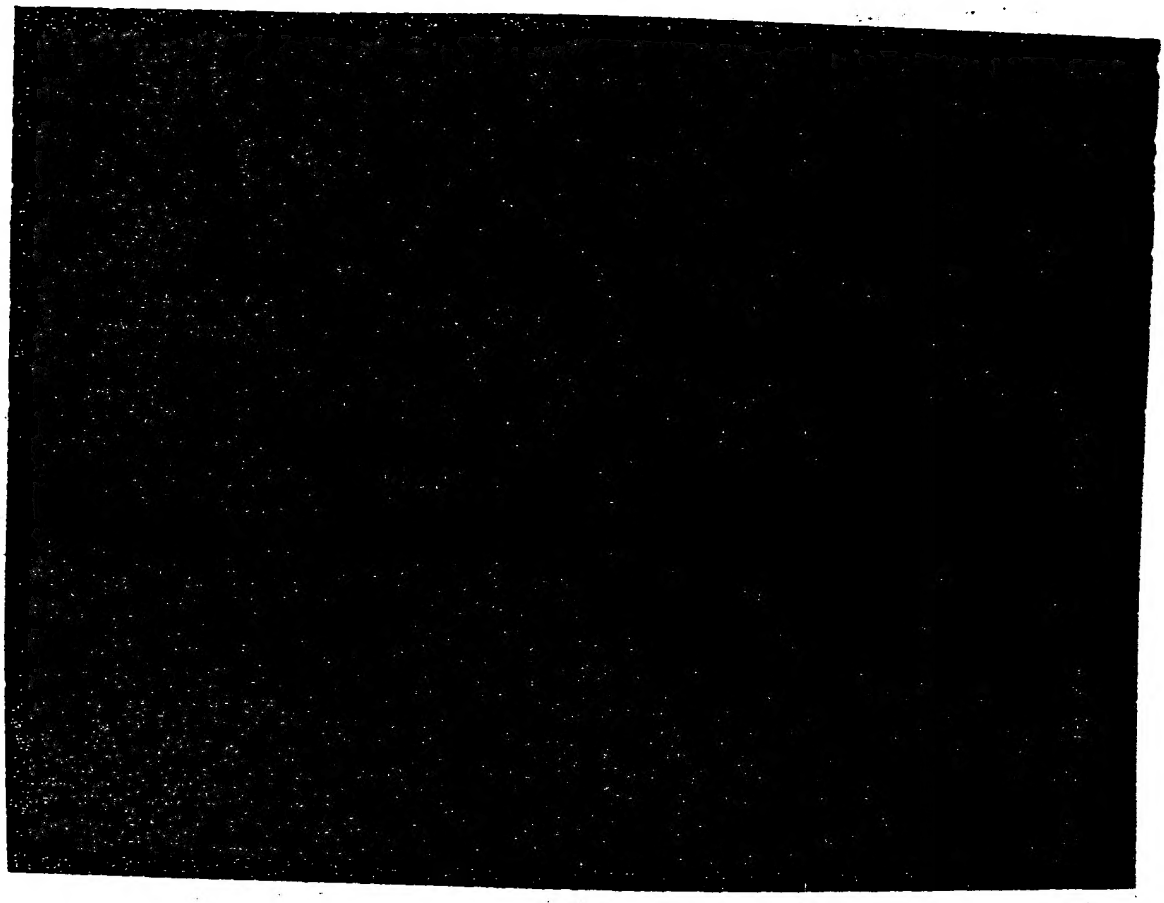
are available on the open market. Under optimum conditions the facility could be built in a few months and could then produce several kilograms of plutonium a day--enough for several weapons--in an extremely brief period. But the technical skills of the Pakistanis are probably still too rudimentary to permit any such early success. For at least the next five years, and possibly much longer, such a facility will likely remain beyond their reach.



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The Pakistani Nuclear Outlook

63. Despite the absence of detailed and specific information, current reporting appears to reflect not merely an absence of a sense of urgency but a Pakistani willingness to give its total nuclear program a relatively lower priority than did its predecessor.

64. General Zia's Martial Law Administration has declared it will continue all projects begun by its predecessor; it affirms it wants the French to honor its original agreement to build a reprocessing plant. But it insists it is a temporary government and will not make any new or longer term commitments. This may even extend to the Chasma nuclear power plant, whose estimated costs have skyrocketed, possibly to the point that the project--and the whole ambitious 30 year power program--may be scrapped.

65. So too may its efforts to become a nuclear weapons power or even to set off a single, non-repeatable explosion--ifit finds that it can no longer expect to acquire facilities capable of processing more than token amounts of plutonium.

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The incentives for Pakistan to "go nuclear" remain as potent as ever, but its capabilities to do so have been put much more in doubt than even a year ago.

66. In sum, and despite our unawareness of some facets of the Pakistani nuclear program, the available data points to a judgment that even a very crude Pakistani nuclear device is probably many years away. A mix of lack of scientific know how, likely absence of and inability to acquire critical reprocessing facilities capable of producing usable plutonium, severe financial problems, fear of a very active Indian response, and a continued uncertain political atmosphere all increase the odds against Pakistan going nuclear--perhaps for the next decade or longer.

67. But a change in the above adverse factors--particularly if Pakistan can acquire more than token amounts of plutonium--would greatly enhance the likelihood of Islamabad's seeking to acquire a nuclear option.

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